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A DESCRIPTION OF CERTAIN
INSTANTANEOUS
DRY COLLODION PROCESSES
AND ALSO OF
A NEW SET OF APPARATUS
FOR
PREPARING DRY PLATES

BY
THOMAS SUTTON, B.A.

LONDON :
SAMPSON LOW, SON, & MARSTON, 14, LUDGATE HILL.
1864.

Two Shillings.

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SAMUEL J. W. BOWEN, M. D.

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BY
THOMAS SUTTON, B.A.,

Author of the "Collodion Processes Wet and Dry,"
a "Dictionary of Photography," &c.;
and Editor of "Photographic Notes."

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AND TO PREPARING DRY PLATES

BY THOMAS STUTTON, R.A.

OF THE PHOTOGRAPHIC SOCIETY OF LONDON

AND OF THE PHOTOGRAPHIC SOCIETY OF AMERICA

IN TWO VOLUMES. VOL. I.

THEORY AND PRACTICE OF THE DRY COLLODION PROCESS

AND THE PREPARATION OF DRY PLATES

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P R E F A C E .

THERE is just now a strong desire among photographers to improve in the artistic character of their works, and raise Photography to the dignity of a Fine Art, if that be possible. Among the rules for this year's Exhibition of the Photographic Society is the following significant clause:—"The Council are anxious for the advance of the Art; and mere proficiency in photographic manipulation is now so common that they are desirous to show, by the specimens exhibited, a real progress in photography as a Fine Art. They call therefore on their brother members, and others who will honour them by becoming co-exhibitors, earnestly to seek to advance in that direction." This exhortation is capital; but then comes the question how are amateur photographers to work with any spirit at trying to raise the art character of landscape photographs when they have only the choice of the

wet collodion process on the one hand, with all its accompanying "pestiferous fag, and toil, and expense,"—and the common dry processes on the other, with the very long exposure required, and the risk of getting the hard black and white pictures which have all along been the reproach of photography? With such processes as these, amateurs are not to be blamed if the walls of a photographic exhibition show but few subjects happily chosen and successfully treated, among a large number of works devoid of all interest except as illustrations of the difficulties and weaknesses of the art,—or which do not at any rate reach a high standard of excellence.

There is trouble enough in the field in choosing the subject, fixing upon the best point of view, watching for the most favourable effect of light, or the most happy circumstances under which to take the picture, focussing carefully, and looking after all the little matters connected with the mere exposure of the plate, without having the additional anxiety of preparing and developing it in a tent set up on the spot, in the midst possibly of heat, wind, and dust, or of a troublesome group of spectators, sometimes mischievously inclined. Until the amateur is relieved from all the extra botheration of the wet collodion process, and can prepare for himself a really good dry plate as sensitive

as a wet one, and which will preserve its good qualities for a few weeks at least, and will yield a soft artistic picture, perfect in its gradations of tone, it is next to useless to preach to him about raising his hobby to the dignity of a fine art, and trying to take prettier pictures. Considering the processes which have been employed hitherto, photographers have really done wonders in taking views, and have shown an amount of pluck and perseverance which were hardly to be expected from them; but there are limits to human patience and powers of endurance, and if better things are to be done than have been done yet, and if the standard of excellence is to be raised, a better process than those hitherto used in the field is imperatively needed.

It is my object in the present little treatise to point out that better process, and exhort photographers to adopt it. By means of it they can prepare a dry plate as sensitive as a wet one,—which will preserve its good qualities on a tour for several weeks,—which will yield a picture unsurpassed for softness and beauty,—and which will possess a uniformity in its action, and a freedom from annoying causes of failure which would alone recommend the process beyond all others that have been hitherto published.

The method described is so far new that it was not known or practised by anyone until towards the end of the autumn of last year; but I have since devoted much of my time to working it out, and have sent to England for inspection a considerable number of negatives taken by it, which have met with general approval. I have also given a negative, taken exactly in the manner described, to Mr. Mullins, of Jersey, and he will be happy to forward a print from it to anyone desirous of seeing a specimen, on the terms stated in an advertisement at the end.

My object therefore in publishing this pamphlet is to call attention to a new and magnificent process, by means of which grand things can be done in landscape photography, and which I am sure is calculated to meet the want long felt by every amateur of taste in his rambles with the camera. At any rate I shall never go back myself to any of the old processes.

T. S.

St. Brelade, Jersey,

April 14th, 1864.

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INTRODUCTION.

THERE has been from the very first discovery of Photography a want felt, by those who apply the art to the purpose of taking views, of a negative process by which a highly sensitive plate, or paper, may be prepared and developed at home, and the out-of-door operations reduced to the mere act of exposing the same in the camera. It has been required also that the sensitive film should be in a dry state, in order that particles of dust may not stick to it; and that it should not be subject to change or decomposition under the ordinary influences to which it must be exposed during the time which must elapse between its preparation and development. These conditions have been, from the first, desiderata by landscape photographers; but it is only within the last year or two that the means of satisfying them have been discovered. For instance, in the Calotype process, originally brought forward by Talbot, the prepared

paper is not highly sensitive, and its keeping properties are bad. With a landscape lens, having a stop whose diameter is equal to the one-thirtieth of the focal length, the exposure of a well-lighted view requires about ten minutes; and the paper cannot be kept for more than a few hours in summer without becoming unfit for use. In the Waxed-paper process of Le Gray, although the papers keep better, they are still less sensitive. In the Albumen process upon glass the plates require four times the exposure of Calotype papers; and in the old-fashioned Dry Collodion processes, with a preservative of albumen, gelatine, tannin, serum, ale, oxymel, or raspberry vinegar, &c., the exposure is nearly as long as that of Albumenized plates, and much longer than that of Calotype papers. None of these old dry processes, therefore, satisfy the required conditions; and we have to seek among the new methods, which have been introduced within the last year or two, for one by which a film can be prepared as sensitive as a good Wet Collodion film, and which will possess tolerably good if not indefinite keeping qualities.

Without alluding to any of the new Dry processes by which extra sensitiveness is gained either by the addition of resin to the collodion, or of gum arabic to

the preservative, and in which the usual method of development is employed, with acid pyrogallo-nitrate of silver, I have confined myself in the body of this Treatise to a description of a New Dry Process, in which the required conditions of rapidity or instantaneity of exposure, along with good keeping qualities, are realized; and that by means of a new method of development applied to a dry collodion plate prepared with Tannin in the old-fashioned way. This new mode of development consists in the use of an ALKALINE instead of an acid developer, and thus the details of the latent image are as fully brought out after a very short exposure as they can be by an acid developer after a very long exposure. Dry plates may, therefore, in this way be rendered as sensitive as Wet collodion plates in ordinary good condition; and instantaneous views of breaking waves, or animated figures in motion, can be taken upon them equally well. Their keeping properties are also as good as those of Dry plates prepared by any known formula.

The Instantaneous Tannin process described in this work is the result of a large number of experiments in which I have been engaged for the last six months. It is so far new that no one has previously published it in its present form, nor have the materials of

which my developer is composed been recommended by any other person before. The only approach to a process resembling that now described, and for which exalted sensitiveness is claimed, is one with Bromised Collodion, and an Alkaline developer containing carbonate of ammonia. But, unfortunately for the claims of that process, it has been generally condemned as a failure, and no photographer of reputation has succeeded with it. As for the merits of my own process, upwards of a hundred negatives which I have taken by it have been exhibited in England and approved; and a print from one of them can be purchased by anyone desirous of possessing an illustration. As a proof of the instantaneity of my plates, I have also sent to England for exhibition a negative upon a dry plate prepared by me in the manner now described, one half of which represents breaking waves, and the other half a country lane some miles distant from the sea, and taken on a different day; a feat which could not be accomplished with a wet collodion plate, and one which ought to satisfy the most sceptical.

With such proofs as these, and knowing as I do from large experience of the process its other great merits of certainty in result and simplicity of manipulation, I feel justified in strongly recommending it to

notice as a successful practical solution of the problem of rapid dry collodion,—a problem which has occupied many experimenters for many years, and the solution of which is mainly due to the application of a variety of facts which have become known, and hints which have been suggested.

But in addition to the value of this new process as a dry one, it has another important feature, viz.: that if the plate be exposed immediately in its wet state and then developed in the manner described, a magnificent negative can be obtained with one half the exposure that is now required for a wet collodion plate prepared in the usual way, developed with iron, and in its most sensitive condition. This is a very important fact, and one well worthy the attention of photographic portraitists. It was first observed by me; and this new wet collodion process was first published in a leader in *Photographic Notes* of March 15, 1864. The fact may be turned to good account in a general simplification of the Collodion Processes both Wet and Dry, to the great gain of the practical photographer in many ways.

To all those who are desirous of taking up Photography, either as an intellectual and artistic hobby, or for artistic purposes, I would say now is the time

to do so. After twenty years of fag, and mess, and failures, the good time has at length come when the art has been sufficiently perfected for your purpose. In a week any intelligent person may now learn the manipulation of a very certain, simple, and admirable dry process, by which he may take any kind of subject that has yet been successfully treated, either upon wet or dry plates. Photographic chemicals of the best description can be obtained fit for this process at a reasonable cost; printing can be done with greater certainty than heretofore; lenses can be obtained for including any width of angle that the subject may require; and apparatus of improved plan and excellent construction is manufactured to suit the exact wants of the landscape photographer and artist. Now therefore is the time to take up photography; and also perhaps for some old photographers to look about them and see whether their own paraphernalia and operations may not possibly be open to improvement.

The above remarks are not hastily made, or the advice inconsiderately given. I am not speaking from limited knowledge, or narrow experience, or as a mere writer of pamphlets. From the very first discovery of the art, photography has been a favourite hobby of mine, and for the last twelve years a hobby which

has occupied most of my time. For nine years I have edited a photographic journal; and during that time have suggested several novelties which have turned out well. Need I say, therefore, that I have watched the progress of this new art with no ordinary attention, and that the opinion of such an old stager ought to be worth something to the tyro. Here it is then, emphatically given, to the effect that now is the time for any one to take up Photography with advantage and comfort and pleasure to himself,—and THIS the process which he should use, to the exclusion if he likes of every other, wet or dry. It combines every good quality of every published process that has been discovered up to the present time; and there is no other to surpass it for softness and beauty of result, delicacy of detail, rapidity of action, simplicity of manipulation, and certainty of success.

In an Appendix I have described two other Rapid Dry Processes, which are chiefly interesting, as throwing light upon the theory of this subject. They are my own Gum process, and Mr. Fothergill's new Albumen process.

the remarkable mode of application. For nine years I
have edited a photographic journal; and during that
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come to pass. When I say, therefore, that I have
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attention, and that the opinion of such an old writer
regarding it is worth something to the world, I mean it is
an opinion, especially given to the effect that now is
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advantage and comfort and pleasure to himself—and
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of all others of every other, yet to try. It combines
every good quality of every published process that
has been discovered up to the present time; and there
is no other to surpass it for swiftness and facility of
work, delicacy of detail, rapidity of action, simplicity
of manipulation, and certainty of success.

In an Appendix I have described two other kinds
of processes which are chiefly interesting as throwing
light upon the theory of the subject. They are the
cyanotype process, and Mr. Foxhall's new Albumen
process. The former is a process which is now in vogue,
and the latter is a process which is now in vogue,
and we would mention the plates prepared by these
processes as being of great interest and value.

INSTANTANEOUS TANNIN PROCESS.

By an Instantaneous process is meant one by means of which instantaneous views can be taken of breaking waves, or animated figures in motion, with a lens having an aperture large in proportion to its focal length; such as a portrait lens either without a diaphragm, or with one of its larger diaphragms. If, for the sake of convenience, we agree to call the ratio which the diameter of the aperture of the lens, or of the diaphragm, bears to its equivalent focal length the APERTAL RATIO, then, by an instantaneous process is meant one by means of which instantaneous views of waves, or moving objects, can be taken in a good light with a lens having an apertal ratio ranging from one-tenth to one-fourth. Instantaneous views can be so taken upon wet collodion plates; and in designating any other process, either wet or dry, an instantaneous one, we simply mean that plates prepared by that process are as sensitive as wet collodionized plates in their best condition.

It must not be supposed, however, that if a photographic view should exhibit the natural clouds taken upon the same plate as the rest of the subject, the process employed was an instantaneous one. Nothing is easier than to take clouds with a lens having the smallest stop, and upon a plate prepared by the slowest of all known processes, provided the clouds are not drifting rapidly,—because the exposure in this case need not exceed ten seconds, and clouds at a great height do not apparently move much in that time in calm weather. Nothing can therefore be gathered with certainty as to the rapidity of a process from the mere reproduction of clouds in a photograph. But if moving figures, or breaking waves, at a distance not exceeding thirty yards from the camera, are represented in the act of motion, then the process employed must of necessity be instantaneous, and the exposure could not have exceeded the fractional part of a second. The distance of the moving objects from the camera is an important element in taking instantaneous views, or estimating the rapidity of a process; and a distinct picture of a moving object at fifty yards from the camera may be obtained when not a trace could be got of the same object crossing the field at a distance of a yard or two from the lens. The meaning of the term instantaneity, as applied to a process, must not therefore be construed too literally; but the latitude allowed in the common acceptation of the term among photographers must be granted.

It will be understood, therefore, that plates prepared by the process about to be described, and called the "Instantaneous Tannin Process", can be made as sensitive as wet collodion plates in their best condition; and that as good and perfect negatives can be obtained upon such plates, with the same exposure under the same circumstances.

It is now about three years since the Tannin process was first brought forward by Major Russell. In its original form bromo-iodized collodion was used, and a very acid nitrate bath, after which the plate was thoroughly washed, and a solution of tannin poured over it; the exposure required was at least six times that of a wet collodion plate, and the development was effected by means of acid pyrogallo-nitrate of silver. According to the process described in the present work the same bromo-iodized collodion is used, but the nitrate bath, instead of being very acid, is nearly neutral; the same solution of tannin is poured over the plate; but the exposure is not longer than that of a good wet collodion plate, instead of being at least six times as long; and the development of the latent image is effected by an *alkaline* solution of pyrogallie acid instead of the acid mixture formerly used, and which is now only employed as an intensifier. By these important modifications a very slow dry process has been converted into a very rapid one.

With respect to the use of Tannin as a preservative, that is not essential, nor does the chief merit of the

process consist in its use. An ammoniacal solution of albuminate of silver may be used instead of Tannin, and with equal success, as will be shown in the Appendix. But Tannin forms a very simple and excellent preservative among several which might be used in its stead, and it is recommended for minor reasons, which will be stated as we proceed. The important feature of this new process does not therefore lie in the nature of the preservative but in the use of an alkaline developer, and of the collodion and bath in a suitable condition for obtaining the most exalted sensitiveness of the film.

We may now pass on to the particulars of the process. A brief outline of it will first be given, and the various operations will afterwards be separately and more minutely described.

OUTLINE OF THE PROCESS.

1st Operation. To grind the edges of the glass plate, and then clean and polish it.

2nd. To coat it with a film of bromo-iodized collodion.

3rd. To excite the film in a bath of nitrate of silver ; then wash it, and apply the Tannin preservative.

4th. To drain, dry, and pack up the sensitive plate, so as to be ready for use when required.

5th To expose the sensitive plate in the camera.

6th. To develop the negative picture by means of an alkaline solution containing pyrogallic acid and carbonate of soda.

7th. To intensify the feeble negative thus obtained by means of an acid solution of pyrogallo-nitrate of silver.

8th. To fix the negative with hyposulphite of soda, and then wash and dry it.

9th. To varnish the negative.

In the following description of the above operations it is assumed that a *flat* glass plate is used, and not a *curved* glass for Panoramic purposes. A treatise on Panoramic Photography will be published shortly, in which the manipulation of curved glasses will be fully described.

FIRST OPERATION.

To grind the edges of a glass plate, and then clean and polish it.

There are three kinds of glass plates manufactured for photographic purposes, viz.: Patent Plate,—Flatted Crown,—and Crystal Sheet. Of these Patent Plate is the best, its chief advantage consisting in its perfect flatness, so that it does not get broken by unequal pressure in the printing frame. It is however much dearer than the other two kinds. Of course it is better not to risk the loss of a valuable negative by

using the cheaper kinds of glass, and the latter should only be employed for experimental purposes ; or at any rate a careful selection should be made of the flattest pieces for the most important negatives. Another advantage of patent plate is, that you can get perfect contact between the negative and the sensitive paper in every part, which cannot always be done when the negative is taken upon a common glass ; besides which, the definition of the picture is sometimes faulty in parts where there are hills or hollows in the common glass, or where the curvature of the glass is in an opposite direction to that of the optical image in the camera. Patent plate can be obtained, either colourless, or with a slight tinge of green. If colourless, it is softer than the other and more easily scratched, while the tinge of green does not introduce any serious practical objection. The glass should be thick enough to bear safely the pressure in the printing frame, but not so thick as to run the risk of being cracked by the sun's heat during its exposure,—to say nothing of the extra weight which a number of thick glasses involve in the carriage from place to place on a tour. Plate glasses can be purchased, ready ground at the edge, at a moderate extra charge, and this saves the photographer the disagreeable job of grinding them. Common glasses may have their edges roughened by rubbing the edge of one glass along the edge of another, and this will generally be found sufficient to prevent the film from splitting off. Small grooved

pieces of stone, made for the purpose of roughening the edges of glass plates, can be bought at most of the Photographic Dépôts, and they answer the purpose tolerably well.

Messrs. Chance, of Birmingham, are the largest manufacturers in England of glasses for photographic purposes, and they supply the plates of any size, wholesale or retail, either with or without ground edges. Glass plates can also be obtained from Mr. Forrest, of Liverpool; or in fact at any Photographic Dépôt in the country. Care should be taken never to pack them between printed papers, because it has been found extremely difficult to obliterate all trace of the letters impressed upon the glass, even by the strongest chemical agents.

A new glass plate, which has never been used before, should be first cleaned by rubbing it all over with whiting made into a thick paste with water, and applied with a piece of flannel; after which it should be put under a tap and the whiting cleaned off with a sponge kept for the purpose; and lastly, the plate should be put into water acidified with vinegar, in order to destroy all trace of alkalinity, and then washed again. It should be wiped dry with cloths kept for the purpose, and which have never been washed with soap. A plate upon which an unsuccessful negative is taken should be washed clean at once, and then this washing will suffice, no whiting being required, but water only. But after a plate has been used ten or

a dozen times it will require treatment with nitric acid, in order to remove all traces of former chemicals; or it may be a case of discarding it altogether as worthless, for old and much-used plates rarely give perfect pictures.

When the plate has been cleaned and wiped dry it should be put away in a grooved box until wanted. It is hardly necessary to say that abundance of water should be used in washing the plate, and that it should never be touched on the face with the fingers; neither should it be allowed to drain and dry spontaneously. Be particular also to clean off all particles of whiting from the edges, and not leave any in scratches upon the glass. The whiting should be kept in a covered gallipot, and no gritty particles allowed to get into it. There is no simpler method of cleaning glass plates than that now described.

It is very important that the plate should be perfectly dry and well polished when the collodion is applied, and the operation of polishing is of course done immediately before you coat the plate. It must first be rubbed with a dry cloth, and then polished with a silk handkerchief, or piece of wash leather, made up into a ball. The cloth and silk, or leather, should be dried before they are used. Any dampness in the cloth with which the plate is finally rubbed will shew itself in streaks upon the negative in the direction of the last rubbing.

A very convenient board upon which to polish the plate may be made thus:—Take a piece of board of suitable size, clamped at the ends across the grain to prevent warping, and planed perfectly smooth. Cover it with cotton velvet. Underneath it nail a cleet to hold it against the edge of the table. Upon the velvet, and against the longer side of the board, nail another narrow cleet, shaped like a flat segment of a circle and with the hollow side inwards, and having the end at the right hand corner of the board shaped like a hook, so as to form a notch to hold one corner of the glass plate whilst the adjacent corner rests upon some point in the concave side of the cleet. It is evident that when the plate is laid upon the board to be polished only two of its corners will touch the cleet, and it will not touch the cleet along its entire edge. In order to hold tightly a third corner of the plate, and also to adapt the polishing board to plates of different size, a moveable revolving bar is attached to the board by a screw at one end about which it turns. The edge of this bar need not touch the glass except at its corner, and therefore by pressing this bar against the third corner of the glass it can be held tightly with the left hand whilst it is being polished with the right. The reader must have a polishing board of this kind made to his order, because those sold at the shops are not made on so good a principle, two edges of the glass plate being allowed to touch wooden cleets along their whole length. In all photographic operations with

glass plates it should be laid down as a rule that the plate must not be allowed to touch anything *along* its edges, but only at its corners, or at points of its edges, or against its back.

The polishing board should be brushed with a clothes brush to remove dust; and that, as well as the polishing pads and cloths, should be kept free from all contamination of chemicals, wet, and dirt.

The plate is polished by rubbing it briskly in all directions with the silk or leather pad. When well polished the condensed breath dries off it quickly, and shews no clear irregular streaks where the glass does not take the vapour.

Failure in this first operation results from a damp, dirty, or ill-polished glass; and as a consequence streaks and stains are produced in the negative, as well as peculiar irregularities in the film, and imperfect adhesion of it to the glass.

THE PRELIMINARY COATING.

One of the defects to which all dry collodion plates are liable is that of the loosening, wrinkling, or splitting of the film during the operations of developing, fixing, or washing the negative. The loosening and wrinkling of the film occur when the edges are fastened down, so that it cannot expand evenly upon the glass when wetted a second time, and the effect is that the

negative when dry exhibits curious dark lines or marks, like a stag's horns, or the branches of a tree. This evil does not, however, commonly occur with collodion properly made and in good condition. Splitting of the film is produced by the liquid getting under the edge and detaching a portion of it bodily from the glass; and this misfortune may happen with the best collodion unless proper means are taken to prevent it. It occurs in the wet process also when the collodion is too thin, and contains insufficient pyroxyline to give it body and strength.

Both the annoyances above described may be entirely prevented by applying to the plate, after it is polished, what is called a PRELIMINARY COATING. A variety of solutions have been proposed for this purpose by different persons, but the best seems to be a solution of one grain of gutta-percha, or India-rubber, in an ounce of any suitable solvent. This is to be poured over the plate in the same manner as collodion, and as soon as the film has set the plate must be held before a hot fire and strongly heated, so as to melt the gutta-percha or India-rubber, and make it stick tightly to the glass. It is important to heat the plate, because this makes sure work of the operation. Kerosolene, chloroform, or benzole may be used as the solvent, and it is quite immaterial whether the substance dissolved be India-rubber or gutta-percha. The coating fluid does not dim the glass, but leaves it as clear and transparent as before.

I have some stereoscopic negatives in my possession in which one half of the plate only has been coated with India-rubber or gutta-percha solution, and the other half bare. These negatives shew no difference in the sensitiveness of the two parts of the film, or in their transparency or density, but the negative upon the uncoated half of the plate has generally split at the edge, while the other has not. I have also a negative taken upon a plate one half of which has been coated with a solution of India-rubber and the other half with one of gutta percha, but these shew no difference whatever in their photographic qualities; they were prepared, exposed, and developed together, and are exactly alike. This proves that it is immaterial whether you use India-rubber or gutta percha in the coating fluid. Another experiment which is interesting is this: coat one half only of a small stereoscopic plate with the coating fluid, and then take a negative upon the whole plate in the usual way; when finished, wash it violently under a pump or tap, and you will find the film torn to pieces from the bare glass, whilst the half which is upon the coated side of the plate resists the violent ill usage. It is, in fact, very difficult to clean the film off this side of the glass. Experiments of this kind are convincing as to the efficacy of the coating fluid, if you don't mind the extra trouble of using it.

It must be understood, however, that there is no absolute necessity for the use of a preliminary coating to the plate. On the contrary, if the film sticks well

to the glass, and you find it enough to grind the edges and run a border of varnish round the film, in the manner which will be described presently, it is better *not* to use the coating fluid, because every additional film which you spread upon the glass brings its own peculiar imperfections, as well as specks of dust which adhere to it, and so on. If good and suitable collodion is employed there will, as a rule, be no necessity for a preliminary coating; and thus a troublesome operation is avoided and some expense saved. If, however, it should be found really necessary to use some means of increasing the adhesion of the film to the glass, then the only solution which can be recommended is that of India-rubber or gutta-percha; and nothing else seems to answer so well in this process. The reader is cautioned against using either albumen or gelatine as a substratum for the collodion. They may suit other processes, but they do not suit this; or at any rate their use is attended with drawbacks from which that of the India-rubber solution is free.

SECOND OPERATION.

To Collodionize the Plate.

The composition of the collodion is a matter of vital importance in this process; much more so than the state of the bath, or the other chemicals. For instance, I have on a shelf in my laboratory three bottles containing different kinds of collodion. The first is

that which I recommend as the best ; it is bromo-iodized, quite colourless, and made with purified methylic solvents. The second is made in exactly the same way but with pure solvents ; it is rather old, and has a slight tinge of yellow colour. The third is old red potassium-iodized collodion, made about six months ago, with a common sample of ether. On comparing these three kinds of collodion, treated in the same way, the relative time of exposure required is as two to three to a hundred ; in fact the red sample of collodion will not give a decent picture at all, with any bath, old or new, acid or neutral. The first two samples give equally good pictures, but the first is much more sensitive than the other, owing chiefly to the means used for purifying the ether and alcohol with which it is made, and partly perhaps to a peculiarity which methylic ether possesses of re-absorbing free iodine which has once been liberated in it.

Such experiments as the above, oft repeated and greatly varied, leave no doubt as to the best collodion to employ for this process, and the following is the formula by which it is made :—

PLAIN COLLODION.

Pyroxyline...	...	...	...	...	...	6-grs.
Ether, S.G. '725	...	...	...	...	...	5-drs.
Alcohol, S.G. '805	...	...	...	...	...	3-drs.

BROMO-IODIZING SOLUTION.

Iodide of cadmium...	...	...	...	...	16-grs.
Bromide of cadmium	...	...	...	...	6-grs.
Alcohol, S.G. '810	...	...	...	...	1-oz.

Add one part, by measure, of the Iodizing solution to three parts, by measure, of the Plain collodion. Shake it well up and leave it undisturbed for a few hours; then draw off the top carefully with a syphon, or pass it through a collodion filter, and it is ready for use. This collodion is quite colourless, and if kept in a cool place it will retain its good qualities for a considerable time.

The pyroxyline should be made according to the formula given in my treatise on the "Collodion Processes, Wet and Dry." It should dissolve entirely, without any sediment, and yield a clear solution which might be used at once without standing to settle; although it is a wise precaution to treat it in the manner described in order to remove foreign particles. No trace of acidity should contaminate the pyroxyline, and it is a good plan to add a pinch of soda to the water in which it is washed, as described in the treatise referred to.

The ether and alcohol should be methylic, but redistilled with lime and charcoal, so as to neutralize all acidity and remove traces of fusel oil and other impurities. Methylated solvents treated in this way yield a more sensitive collodion than pure solvents however highly rectified; but on the other hand, collodion made with common methylated solvents, which have not been highly purified, is to be scrupulously avoided, for success in this process is impossible with such collodion; although it may be found possible

to take negatives with it in the ordinary way, by using a strong iron developer. Unfortunately nearly all the cheap collodion in the market is of this unsuitable quality, and therefore if persons fail with it in this process they must blame the collodion and not the process. The probability is that the common bad collodion is acid from the presence both of oxalic and iodic acids, besides containing fusel oil; and its use will infallibly bring thin foggy insensitive films, and put the bath out of order. Purified methylic collodion, made according to my formula, can now be obtained from Messrs. Bailey at 6d. per ounce, and this is found to answer the purpose admirably.

The collodion when iodized contains equal parts, by measure, of ether and alcohol, and the solvents are a trifle stronger than those used in collodion for the wet process, because there is now less fear of the developer not flowing easily over the plate.

When the pyroxyline is good there is no necessity to add an alkaline iodide to the collodion in order to make it more fluid; and it is better to use the cadmium salts alone, because they are the most stable.

It is very important to add a bromide to the collodion in this process, because that preserves to it the property which it originally possesses of giving a highly sensitive film. Iodized collodion, fresh made, and in its best condition, is as sensitive as bromo-iodized collodion; but it undergoes gradual change, and loses its original sensitiveness much more rapidly.

The most sensitive films are obtained with a new and colourless collodion, made with fresh distilled ether and alcohol. Old collodion is not so sensitive as new; and if it has acquired a deep colour it will be found extremely slow in this process, although it may answer well enough for positives, or thin negatives developed with iron. The more you can avoid those causes which tend to produce changes in the ether, with the liberation of iodine in the collodion, the more sensitive the film will be in this process; and the fact is curious because it is found that the addition of nitric acid to the nitrate bath does *not* diminish the sensitiveness of the film, even when added in the proportion of 3-mins. to the ounce of bath solution. The use of a suitable collodion is, therefore, one of the chief points to be observed in this process. It is the main secret of success. The rest is very little beyond mere manipulation.

Coat the film in the usual way; let the film set the usual time, and then immerse it in the nitrate bath.

THIRD OPERATION.

To render the Film sensitive to Light.

The plate must now be immersed in a solution of nitrate of silver, strength about 30-grs. to the ounce of distilled water.

The nitrate of silver should be of the purest kind, and trebly recrystallized. That which is prepared for the negative collodion processes, and put up in her-

metically sealed glass tubes, is the right sort, and no other should on any account be used. The solution thus made is not in the slightest degree acid to test paper, but it should be slightly acidified either with acetic or nitric acid,—it does not much matter which, but perhaps acetic is the safest. I have always been in the habit of adding 1-min. of glacial acetic acid to 4-ozs. of bath solution, and this has answered perfectly; but lately I have tried nitric acid instead, and that seems to answer just as well, and does not reduce the sensitiveness of the film as one might expect. The solution should always be filtered before use, in order to remove undissolved particles which produce black comets in the negative; and it is a good plan to leave a coated plate in it, in order to satisfy its first avidity for iodide of silver.

The nitrate bath always works best when fresh made; and an old bath, saturated with double salts of silver and organic matter, is very liable to give veiled negatives. As soon as this happens the best plan is to make a new bath, and throw down the silver in the old one with salt, and add the chloride to the silver residues. You cannot cure the vagaries of an old worn-out bath, and the mere addition of silver to bring it up to the right strength does not always make it work well. For home use it should always be kept in a glass vessel, or if gutta-percha is used for a bath when travelling it should be made of the very best material. Baths manufactured by the Gutta-Percha Company do

not seem to injure the nitrate of silver solution, but there are impure kinds of gutta-percha used for this purpose by other makers, which have been found to put the nitrate bath out of order very quickly.

The plate should be left long enough in the bath to give a full creamy film of a greenish-yellow colour. About three minutes in summer, and six minutes in winter, will in general be sufficient. Wash off the greasy lines in the usual way; let the plate drain for a few seconds; and then immerse it in another upright bath, containing either distilled or clean rain water. In this water it must remain during the time occupied in collodionizing and exciting another plate.

When the plate is first put into the water the greasy lines upon the film return, and these should be washed off immediately by moving the plate up and down in the water. These greasy lines appear most when the collodion is made with the strongest solvents, and least when it contains most water. They proceed apparently from a repulsion which exists between the collodion film and water, and not from the presence of ether in the film. This is evident from the fact that a film of ALCOLENE, which contains no ether, gives the greasy lines just as much as a film of common collodion.

The first water may be used for about a dozen plates in succession. It will probably become slightly turbid, but that is of no consequence. When done with, throw it into the vessel in which you collect silver residues.

When the plate has remained the proper time in the water, that is to say about five minutes, remove it, and holding it horizontally upon the tips of the fingers of your left hand, pour from a jug held in the other, a large quantity of clean rain water. In doing this, hold the lip of the jug an inch or two above the plate, and travel all over the plate with the jet of water, but more particularly round those edges where the collodion is thickest, so as to wash the free nitrate of silver out of the film. Then wash the back of the plate, and afterwards the film once more. A plate 8×6 would require at least a quart of water to be poured over it. Let the water drain off rather closely. The plate is now ready for the Preservative solution of Tannin, which is next to be poured over it.

THE TANNIN PRESERVATIVE.

Make a solution of TANNIN, strength 15-grs. to the ounce of water, and filter it through blotting paper. This is the tannin preservative. Its office is, not to preserve or increase the sensitiveness of the film, but to preserve the purity of the lights and increase the density of the blacks of the negative. The proof that it has no effect in increasing the sensitiveness of the film is, that if you omit the tannin, and expose and develop the simply washed plate, you get the same amount of detail with the same exposure, but the lights are not so pure and the blacks more difficult to intensify. The

plate is, in fact, rather more sensitive without the tannin than with it, but it does not yield satisfactory negatives in that state.

Pour a small quantity of the preservative solution upon the plate and let it flow over it backwards and forwards several times, and to all the corners and edges; then drain it off into the sink, and pour a second lot over the plate in the same way. Put up the plate to drain for a few minutes whilst you are preparing the next, and then place it carefully in the drying box. A very good and simple kind of draining tray and drying box are described in the second part of this treatise. It takes altogether about half an ounce of tannin solution for a small stereoscopic plate. Some persons economize the solution by only pouring it once over the plate, or even by using the same solution several times; but this is perhaps a rather risky proceeding.

FOURTH OPERATION.

To Dry and Pack the Sensitive Plates.

The plates should be left for some hours to dry spontaneously in the drying box, with the lid on, and carefully screened from light and dust. There is no necessity to dry by artificial heat, or to employ heat at all, except for the purpose of expelling the last traces of moisture if they are to be carefully packed for long keeping. If they are to be merely kept in

a grooved box for use within a few days of their preparation, they need not be dried at all by artificial heat. You have then to prepare them one day, leave them all night in the drying box, and put them into a common grooved box the next day; after which they must be kept in a very dry place, and not allowed to become moist again. The drying box should be kept as much as possible at an even temperature, so that the plates may drain and dry uniformly; otherwise, patches of unequal density and strange curved lines will be seen upon the plate when dry. Above all things, they must not be placed close together in a plate rack to dry, because then the edges get dry before the centre, and an oval spot is produced in the middle of the plate. Neither must the plate when draining be allowed to stand too long with its corner in a puddle, as this will produce a bad flaw in the negative at that corner. When a plate is put up to dry its entire surface should be equally exposed, so that evaporation may not go on faster in one part than in another; for if this happens patches of unequal density will occur in the dried film. The film has a much less creamy appearance when dry than when wet.

When plates are to be packed carefully for long keeping, they should be tied up together in pairs, face to face, with a narrow frame of cardboard between them at their edge in order to prevent contact; after which each pair should be wrapped up in three folds of yellow paper or calico, so as to avoid the chance

of white light falling upon them. Before packing them up they should be dried, or rather aired, holding them before a hot flat iron, or better still over a flat copper vessel made for the purpose, and containing hot water. Sensitive plates should never be dried before any source of heat which emits light as well, such as by being held before an open fire, or over a spirit lamp or gas jet,—such treatment being the very height of imprudence and folly. Observe also that if a plate is to be dried entirely by artificial heat it should be thoroughly dried at once by a heat which continually *increases*; the plate must not be first half dried by a great heat, and then left to get quite dry by a lower heat, for this would infallibly produce patches and rings upon the film. The gentle heat should be applied first, and the greatest heat last. It is better however not to use artificial heat at all, except for the purpose of airing plates before they are packed for long keeping. In other cases the practice can do no good and it may be a possible cause of failure; to say nothing of the great extra trouble which it involves,—a trouble greater by far than all the other manipulations put together.

FIFTH OPERATION.

The Exposure in the Camera.

There is considerable latitude allowable in this process in the time of exposure. Thus, you may either give the same exposure as to a good wet collodion plate

in its most sensitive condition and to be developed in the ordinary way with an acid iron solution, or you may give six times as long and still save your negative ; the difference being, that in the former case you continue longer the action of the alkaline developer than in the latter case. This power of modifying the development, so as to suit the exposure, is a very important feature of the process, and one which has been long desired and sought after in a process for views, because nothing is so mortifying as to find on developing a dry plate on your return home that it is spoilt through an error in the time of exposure.

But although a magnificent negative can be got by this process, fully developed in the dark shadows and loaded with fine detail in every part, with an exposure not longer than that which a good wet collodion plate would require under the same circumstances, yet it is a good plan to be on the safe side, by exceeding that exposure a little whenever circumstances permit of it, because there is then less pushing required in the development, and less risk of veil or fog over the plate from using a strong alkaline solution. The chemicals will do the work perfectly well if need be, but it is better to make light do the work if you can, particularly if a soft harmonious negative is required.

There is also another point worthy of notice in this process, viz., that the size of the diaphragm should always be proportional to the intensity of the light in the image, because you cannot satisfactorily make up

for want of light by a corresponding increase in the time of exposure. When the light is bad use a large stop, and conversely. When the object is very dark, the stop very small, and the exposure very long, the negative is liable to be much veiled; and not only so, but a curious halo or light edging is seen in the negative round the edges of the dense portions, which gives a disagreeable hardness to the outlines in the print; and at the same time those portions in which the details are imperfectly brought out are the most veiled. But the veil does not extend beyond the boundary of the under-exposed part of the picture; it stops short at the edge, and produces a very queer patch, the appearance of which cannot be easily described. Whenever, for optical reasons, it is necessary to use the smallest stop to the lens, upon a badly-lighted subject, a wet collodion plate would give a better result than could be got by this process. Moreover, this peculiarity is most observable when the nitrate bath is old; with a new bath it is hardly perceived at all.

On the other hand, excessive over-exposure produces an evil which has been called blurring, and which consists in the most strongly-lighted and densest parts of the negative spreading beyond their boundary over the other portions. But this occurs under the same circumstances in wet collodion plates, and the cause is optical and not chemical. Blurring proceeds from reflexion of the oblique pencils of light at the inner

surface of the glass plate, and it is always most strongly marked where the pencils are incident upon the plate at angles of the greatest obliquity. The evil is entirely avoided by exposing the plate with its back instead of its film to the lens, and this at once proves the cause to be optical and not chemical. In a dark slide which I am in the habit of using for stereoscopic pictures, the plate rests with a quarter of an inch in width at each end shaded by wood, so that no light from the lens can fall upon it. Now, in all over-exposed pictures, whether by dry or wet collodion, taken in this slide, the band of sky extends beyond the boundary of the picture over the shaded ends of the plate, the effect being produced by internal reflexion of the most oblique rays at the back of the glass plate. Blurring is also produced sometimes by a lens which is dirty, and therefore diffuses the light. Whenever blurring occurs from the first-named cause alone it is a proof of over-exposure of the brightest parts of the picture. Flat plates, which include a very wide field are particularly subject to this fault near their margin. It is always a good plan, in taking a view, to shade the sky whilst the foreground is receiving a longer exposure. If this sort of thing is not done, subjects which combine much strong light and deep shadow offer great difficulties, unless the plate is reversed in the slide.

Instantaneous views of breaking waves are very easily taken by this process, with a portrait lens either with full aperture or one of the larger diaphragms.

When the light is good they may also be taken by a single view lens, 5-ins. focus and $\frac{1}{2}$ -in. stop. Street scenes, with moving figures, require the collodion to be new, and in its best state. Whatever, in fact, can be taken upon a wet collodion plate, bromo-iodized and developed with iron in the usual way, can be taken with the same exposure upon these dry plates.

Before putting the sensitive plate into the slide, or at any rate before developing it, the edges should be varnished in order to prevent splitting of the film when no preliminary coating is used. The best varnish for this purpose is a solution of 5-grs. of gutta-percha in an ounce of strong methylated chloroform. A narrow edging should be applied all round the film with a camel-hair brush.

SIXTH OPERATION.

Development of the Latent Image.

The development of the latent image is the most critical operation of all, and that which requires the most judgement and experience, because the appearance of the negative during development is unlike that which is exhibited in any other process, and the novice is not unlikely to consider his picture spoiled when it is in fact going on in the most satisfactory manner. Most of my readers have probably seen good waxed-paper negatives, and are aware how well they print, although all trace of a picture is lost when the negative

is looked *at* instead of being looked *through*. So it is with dry plate negatives developed by the alkaline method about to be described. By reflected light they look fogged all over, and shew no details, but when looked through you perceive their fine qualities of clearness in the lights, density in the blacks, perfect gradation of tone, and fullness of detail. These are the negatives which yield the most artistic prints; soft, harmonious, and free from harsh contrasts of black and white. Other kinds of negatives may be prettier to look at as negatives, but this is the kind which yields the finest prints,—such as redeem photographs from the charge frequently brought against them by artists, of being in general either too black, or too chalky, or a mixture of both. The reader must not therefore be afraid if, in following out literally the directions about to be given, his negative should lose its clear blacks when viewed as a positive,—or appear covered with a superficial veil over the details,—or be devoid of surface bloom. It is by *transmitted* light that a negative should be judged; but above all by the positive which can be printed from it.

There are two distinct operations in the development of the negative; the first, which may be called development proper, and in which the picture is brought out feebly in all its details and rendered visible; and the second in which the feeble details are intensified sufficiently to stop the light in printing. These two stages of the development are in this process analogous

to the two corresponding stages in the common operation of developing a wet collodion plate, in which a feeble image is first brought out by means of an acid solution of protosulphate of iron, and afterwards intensified by an acid solution of pyrogallo-nitrate of silver; the only difference being, that in this process an *alkaline* solution of pyrogallic acid is used for the development proper instead of an *acid* solution of protosulphate of iron mixed with the free nitrate of silver which clings to the film.

Should it be found on developing the first of a batch of plates that they have all been greatly overexposed, the best way will be to develop the remainder with the usual acid pyrogallo-nitrate of silver, and not employ alkaline development at all; or at any rate use ammonia instead of soda, and that very sparingly.

For the development of the latent image by the alkaline method, make two solutions according to the following proportions; one being a solution of bicarbonate of soda in water, strength 10-grs. to the ounce; and the other a solution of pyrogallic acid in absolute alcohol, strength also 10-grs. to the ounce. The soda solution should be filtered through a tuft of cotton wool inserted in the neck of a funnel.

As soon as you are ready to develop the picture, put into a measure an ounce of water, and one dram, at most, of the soda solution. Then pour water all over the film, so as to wet it equally and at the same

time wash off the tannin ; and hold it horizontally while you add to the contents of the measure 20-mins. of the alcoholic solution of pyrogallie acid. This mixture immediately takes a pale brown tint ; and it should be well stirred up with a glass rod, or shaken so as to blend the contents thoroughly together. Now, without delay, pour it quickly and copiously all over the film, and keep it flowing backwards and forwards, and to all the edges and corners, whilst you watch the development of the picture. In a few seconds, if the plate has been fully exposed, the sky and highest lights will faintly appear, and in the course of two or three minutes more, the darker details of the shadows will appear also ; but the negative in this state is very thin, and it is impossible to intensify it by this developer, however long you keep it upon the plate. If you wish for a picture exhibiting boldness of contrast between the lights and shades you must stop the development rather soon ; but if you wish for a very soft and harmonious picture, with fullness of detail, you must push the development as far as you can, remembering that the longer the alkaline solution remains upon the plate the stronger will ultimately be the dark details of the shadows. There does not seem to be much risk of altogether destroying the negative, however long the alkaline developer may remain upon it, so that it is safer to leave it on too long than too short a time, particularly if the exposure has been very short ; but if the plate has been fully exposed, and the development is pushed

to an extreme, it may be difficult to intensify the dark parts of the negative sufficiently to stop the light in printing without intensifying too much at the same time the details of the shadows, and for this reason a fully-exposed and over-developed negative will yield a flat pale print. Great judgement is required in the development, and the rule is to push the development if the plate appears underexposed, and to stop soon if the details come out quickly. Great latitude is allowable in the exposure if you develop accordingly; but judgement and tact are necessary in the development, and it is of all the operations the most critical. The negative is now very pale and thin, and you cannot, without some experience, form an idea of what it will be when intensified in the next operation; neither can any exact rules be laid down in so many words for your guidance in developing.

There is one great advantage in the alkaline development over every other, viz., that the solution does not produce irregularities, and stains, or lines upon the film. It is very weak, and may be copiously applied without fear to every part of the film. The development also proceeds in such a way that the highest lights which are first brought out, do not suffer by the prolonged action of the solution whilst the feeble details of the shadows are being developed. In this invaluable property the alkaline developer stands alone, and satisfies a condition which has long been sought for by photographers.

As soon as the picture is sufficiently developed it must be well and thoroughly washed with water, in order to remove the traces of the alkaline solution which cling to the film. Unless the plate is now well washed the picture will be fogged and stained the instant the intensifying solution touches it.

You can now see upon the film a very pale brown negative picture by reflected light, and a pale reddish-brown negative by transmitted light. It differs from a pale iron-developed negative in this respect, that the material of the image is red and easily intensified, while in the latter case it is grey and difficult to intensify.

The proportions given for the alkaline developer are of the maximum strength. A smaller quantity of the soda solution may sometimes be used with advantage. Neither the soda nor the pyrogallie acid alone will develop a picture, if the plate has been properly washed ; but the picture is sometimes rendered visible by the mere action of light in the camera, because not only is bromide of silver darkened by light but iodide of silver also when in contact with tannin. If you see a faint trace of a picture before development, it is a nearly certain proof either of excessive over-exposure, or imperfect washing of the sensitive film.

The alkaline developer is extremely unstable, and the ingredients should not be mixed in the measure

until you are ready to use them. The alcohol in which the pyrogallie acid is dissolved should be absolute, because if it contains water the solution quickly turns brown and loses its energy.

It is safer to use a carbonated than a caustic alkali in the developer. If caustic potass be used it is liable to produce a black stain where it first touches the plate. Ammonia is a solvent of oxide of silver, and also of bromide of silver; it should not, therefore, be used either in the liquid form or in that of carbonate, because it renders a longer exposure necessary by obliterating the finer details of the shadows before they can be developed. If ammonia is dropped upon any part of an exposed plate, it instantly destroys all trace of the action of light. Carbonate of soda appears to be the best alkali to employ; but if ammonia is used instead, a single drop to the ounce of water will be enough, and the plate must then receive double or treble the exposure which would be sufficient for the soda developer.

SEVENTH OPERATION.

To Intensify the Negative.

The feeble negative obtained by the preceding operation must now be intensified, in order that the dark parts may stop the light sufficiently in printing. The degree of density in these dark parts, or blacks as they are called, must depend upon the mode of printing which is to be adopted; for instance, for

common sun-printing upon albumenized paper the blacks must be made denser than for printing transparencies, or for enlarging by the solar camera.

The intensifying solution is a mixture of pyrogallie acid, acetic acid, and nitrate of silver in solution ; and being very unstable it is not made until you require to use it, although its constituents may be kept ready dissolved, so as to be mixed when required.

Into one bottle (glass stoppered) put a solution consisting of

Distilled water.....	1-oz.
Pyrogallie acid.....	2-grs.
Glacial acetic acid	2-scr.

Into another bottle (also glass stoppered) put a filtered solution of aceto-nitrate of silver, consisting of

Distilled water	1-oz.
Nitrate of silver	20-grs.
Glacial acetic acid.....	20-mins.

The negative should be intensified as soon as it is developed, and the operation not deferred. The plate having been thoroughly washed from the alkaline developer, pour over it first some of the acid pyrogallie solution (without silver), in order to destroy entirely any remaining trace of alkalinity in the film ; let this run off into the sink, and then mix in the same measure the intensifying solution by adding to 1-oz. of the pyrogallie solution 20-mins. of the aceto-nitrate of silver. Shake this well up in the measure and

pour it quickly over the plate, which should now be held horizontally upon a suitable holder, so as to prevent blackening the fingers. Let the intensifier flow steadily backwards and forwards over the whole of the plate, but particularly to all the corners and edges, because the centre is sure to take care of itself. By degrees, but not very rapidly, the blacks now become denser; and a thin veil spreads over the plate which hides the vigorous black of the shadows of the picture when viewed as a positive against the black background of the developing tray or sink. But this thin veil need not alarm you, for it is not fog, and if you hold up the negative before the window and look *through* it, instead of *at* it, you find the lights quite clear and transparent. Proceed in this way until sufficient density is obtained, and by that time you will probably find that all trace of the picture by reflected light is lost. But the lights are still clear and transparent when looked *through*; and the blacks dense enough to stop strong sunshine for a time; while between these clear lights and dense blacks there is found every gradation of tone, and no part wanting in detail. This is what a negative ought to be; and the prints from it will be soft and harmonious as a fine engraving, without flatness on the one hand or hardness on the other, but exhibiting just enough of high light and deep black to give force where required, and without unnatural vigour shewn in broad patches of black sticking-plaster, or staring white

patches of bare paper. Even a snow scene in nature presents a certain harmony in its gradations of light and shade which is not found in a bad photograph,—and the open doorway of a dark dungeon or coal-hole does not suggest the idea of a shining patch of black sticking-plaster. Thus, the very veil which during the intensifying of the negative seems to shroud the clear glass of the shadows, acts beneficially in softening the character of the print and making it more artistic and true to nature. Sometimes clear negatives may look very pretty as negatives, but they yield detestable prints. Less vigour in the negative and more softness in the print would be generally an improvement; but be careful to preserve *some* high lights and deep blacks, or softness will degenerate into flatness and monotony.

Some persons prefer citric to acetic acid in the intensifier, but I think that preference injudicious. Acetic acid tends to give a reddish colour to the precipitated silver, and citric acid a blueish-black; but the former being the best non-actinic colour you are able to stop the light with less thickness of deposit, and the negative is therefore more delicate in its details. On the other hand, it may be said, and not without a show of truth, that acetic acid has a tendency to make the film rotten; and that citric acid is more portable and convenient to the tourist. If citric acid be used, 1-gr. is equivalent to 20-mins. of acetic, or thereabouts. When added to a solution of nitrate of silver, a pale waxy precipitate is formed, and some silver wasted, but the solution nevertheless acts well.

I must caution the reader against adding silver from the nitrate bath, or from a printing bath, to his intensifying solution, instead of fresh silver, as that will be likely to produce a curious kind of fog of a greenish colour upon the negative, owing to the presence of a double salt of silver, which acts in an unexplained way. Also, if the film has been excited in a very old or disordered bath the intensifier is liable to fog the plate, for the same reason. The double salts of silver, obtained by the action of a solution of nitrate upon the iodide, bromide, or chloride, produce some curious effects in photography which are at present imperfectly understood.

EIGHTH OPERATION.

To Fix and Wash the Negative.

As soon as you have sufficiently intensified the negative, wash the film well with water, and pour over it, or dip it into a bath of saturated solution of hyposulphite of soda, having previously removed it from the holder. This gradually dissolves all the iodide and bromide of silver in the film, and destroys its yellow colour, but without reducing the density of the negative. This done, wash the negative very thoroughly by pouring water over it from a jug, but in doing so be careful not to loosen or tear the film by using too much violence, for great care is necessary in this last operation of washing. The negative may now be set up to drain and get dry spontaneously, or it may be dried by holding

it before the fire; after which it is ready to be varnished. If there should be any tendency in the film to split and curl at the edges, a little thin gum water should be poured over it after it has been washed, and this should be allowed to get dry upon it.

NINTH OPERATION.

To Varnish the Negative.

There seems to be no better varnish for negatives than spirit varnish, made by dissolving bleached lac in alcohol of suitable strength. The plate must be slightly warmed by holding it before a fire, and the varnish immediately poured over it in the same way as collodion, but without rocking the plate. As soon as all the excess of varnish has run off into the bottle, hold the plate again before the fire, in the same position and without inverting it, until it is as hot as you can bear with your fingers, and the varnish quite set. Lastly, lay it upon a pad of paper, and clean off with a rag dipped in alcohol any varnish which may have run over the back. The varnish when dry gives a film as hard and clear as glass, and which never becomes tacky.

The negative is now finished, and prints may be taken from it when required. It should be kept in a grooved box, resting upon tubes of India-rubber laid on the bottom, and pressed by similar tubes in the lid when shut.

CAUSES OF FAILURE.

THE reader is not supposed to be a mere tyro in photography ; but even if he were it would be an insult to his common sense to lecture him on the importance of care and cleanliness in every part of such a delicate chemical operation as taking a photographic picture. In pointing out some of the chief causes of failure in the particular process which is treated in this work I shall not therefore include such as are obviously due to careless manipulation. Dirty glasses, wiped with damp cloths,—imperfect washing of the plates,—developing measures not chemically clean,—solutions not filtered,—careless weighing and measuring,—a dark room full of dust, or letting in too much actinic light,—the use of impure chemicals and secret empirical preparations,—an ill-constructed camera,—a rickety tripod,—or a bad lens,—all these will produce failures the causes of which need not be particularly discussed, or the obvious means of avoidance insisted on. But there are failures which occur not through careless or slovenly habits, or false economy in the matter of

chemicals and apparatus, but through ignorance of the peculiarities of the process, and the nature of the materials used in it; and it is these failures the causes of which require to be particularly explained.

FAILURES FROM BAD COLLODION.

If the pyroxyline is made with too weak acids it gives an opalescent film; and faint white spots, round, and with softened edges, appear in the negative. Pour a little of the collodion upon a glass plate, and if it does not dry as transparent as the glass reject it.

If the pyroxyline is made with too strong acids, or at too low a temperature, the sensitive film is not even, but covered with lumps or clots of greater density than the rest; and this effect chiefly occurs when the salts of cadmium are used. The only remedy for this evil is to mix the collodion with another sample containing ammonium salts, and that will render it in time more fluid; but its sensitiveness for this process will then be impaired by the liberation of free iodine.

If the pyroxyline is imperfectly washed it will introduce nitro-sulphuric acid into the collodion, which will decompose it and render it highly insensitive.

If the ether contains an acid or ozonised principle, the collodion will quickly become discoloured and insensitive, and it will put the nitrate bath out of order. Good ether only takes a pale lemon tint when

an alcoholic solution of iodide of potassium is added to it. If ether, on the application of this test, quickly turns red, or quickly takes a deep colour and then loses it again, it is unfit for photographic purposes.

If the ether is of the *common* methylated sort, and not purified with lime and charcoal, it contains deleterious volatile matter which quickly puts the nitrate bath out of order, and produces fog and streaks on the negative,—an effect which has been attributed to too much light in the dark room. Purified methylic ether yields the most sensitive collodion, and is the best for this process. This collodion appears to have the property of combining with free iodine, and preserving its original sensitiveness. Pure ether does not often impart this peculiar property to collodion.

If the alcohol in the collodion is too weak the dried negative will show an infinity of small cracks, like a succession of short parallel scratches with a needle, and which are called “crapy lines.” The remedy for this trouble, which is occasioned by too much water in the collodion, is to add to it a sufficient quantity of another sort made with absolute solvents which contain no water.

If the collodion is made with too strong solvents the film becomes too repellant of water, and it is difficult to get rid of the greasy lines which are formed upon it in the nitrate bath; and the solutions will never flow evenly upon it in any of the operations. The remedy

is to add water, drop by drop, to the collodion until it contains the right quantity. The addition of a drop of water to collodion throws down at first some of the pyroxyline, but this is quickly redissolved by shaking the bottle.

If the collodion film is too tender, and easily torn, more pyroxyline should be added to the collodion, and this will render the film tougher and stronger.

Too much alcohol in collodion impairs the adhesiveness of the film, and makes it tender; it also gives thick gelatinous ropy edges along that part of the glass plate from which the collodion was poured off into the bottle.

Too much ether in collodion renders the film uneven, and produces waves of unequal density in it, which have been called "curtains."

If the film is too thin at the top corner, and too dense at the bottom corner of the plate, add more pyroxyline to the collodion.

If the film is over-iodized, opaque insensitive yellow patches and streaks will appear upon it when removed from the nitrate bath. The remedy is to add to the iodized collodion more plain collodion, and a corresponding quantity of ether and alcohol.

If the sensitive film shews a number of yellow specks or lumps add more ether to the collodion. Do this also if the edges are too thick and ropy.

When the collodion becomes thick from the evaporation of the ether, add ether to it to make up for the deficiency.

If the film is not sufficiently creamy add more pyroxyline to the collodion, or more iodide, according to circumstances. A full quantity of pyroxyline and iodide in collodion is an element of exalted sensitiveness in the film.

Never add to collodion any organic substance such as nitro-glucose, glycyrrhizine, &c., for the purpose of increasing the density of the negative; and never use any collodion made by a secret formula, but encourage liberal and open dealing among tradesmen. Rest assured there is no collodion in the market better or more sensitive than that which is made by the formula published in the present treatise.

FAILURES FROM BAD NITRATE OF SILVER.

When nitrate of silver is first made and crystallized from the mother liquor, it is not only intensely acid but it contains an organic impurity which is highly injurious in the negative bath. If you fuse some of these acid crystals of nitrate of silver, and then break the lump, you find it black or deep brown in the interior; and on making a negative bath with this fused nitrate, (properly acidified before use) you find the negatives execrably bad, thin, grey, streaky, foggy,

and the film highly insensitive. This effect is owing to the organic impurity which the nitrate of silver contains, and which is introduced probably along with the nitric acid. But happily this impurity can be removed by recrystallization; and nitrate of silver trebly recrystallized will produce none of the evils alluded to above. Hence the importance of using recrystallized nitrate of silver for the negative bath; and of avoiding as much as possible all contamination of this bath with organic matter.

A pure nitrate bath never requires doctoring with soda, or sunning, &c., but may be used until it gets overcharged with the double salts of silver which are unavoidably formed in it.

The best remedy for an impure nitrate bath is to add carbonate of soda to it until it becomes turbid with carbonate of silver; then let this settle and filter it. Afterwards acidify with a drop or two of acetic or nitric acid; it does not greatly matter which.

FAILURES FROM SPLITTING AND LOOSENING OF THE FILM.

The Kerosolene coating fluid is an *infallible* remedy for splitting and wrinkling of the film, provided the plate is strongly heated after its application. When this is not used the edges of the glass must be ground, and a narrow edging of varnish applied all round the edges of the film with a camel-hair brush, so as to keep

the water from getting between the film and the glass at the edge. The film may now possibly wrinkle, and on drying produce marks like a stag's horns, but it cannot be torn unless you pour water upon it with great violence.

The film never blisters in this process; that evil is confined to those dry processes in which albumen, gum, and some other preservatives are used instead of tannin.

Wrinkling of the film is produced by its first expanding when wetted in the development, and then not shrinking again when dry into its original dimensions. It is a fault of the collodion, and a good remedy is more ether and less alcohol in it.

SPOTS IN THE NEGATIVE.

Spots upon the negative may be either black or transparent.

Black spots, or comets, generally proceed from particles of oxide of silver which are held in suspension in the nitrate bath, or in the silver solution used for intensifying, and which stick to the film. The remedy is of course to filter these solutions. Particles of oxide of silver are always precipitated in solutions of the nitrate after long standing. Black spots sometimes also occur from undissolved particles of pyrogallie acid which stick to the film; here again filtration is the

obvious remedy. Black spots are not nearly so common in washed plates as in ordinary wet plates.

Holes and scratches in the glass which contain traces of former chemicals will sometimes produce coloured spots. These are white if the cavity contains a trace of nitric acid,—black if it contains whiting,—red if it contains hypo.

Transparent spots are generally produced from one of two causes. If their shape, when examined under the microscope, is irregular, they are most probably produced by dust, hairs, and gritty particles which have no chemical action upon the sensitive film, but which stick to it and prevent the light from acting upon those parts during the exposure in the camera, so that when these particles are washed off previous to development they leave unexposed and consequently undeveloped transparent spots corresponding to their own irregular shape. Thus you may often see upon a negative a transparent spiral line produced by a hair which has stuck to the film.

Round white spots have been a great puzzle to dry plate photographers, and it is not known for certain what their cause may be, but most probably they proceed from local defects in the pyroxyline film. These spots have been called moons, and they often increase in diameter the longer the plate is kept, being at first the size of a pin's point, but growing sometimes to the size of a sixpence.

If you examine a collodion film under a magnifier, on its removal from the nitrate bath, you often see its surface dotted over with little raised lumps or hillocks, which are produced either by particles imbedded in the film or enclosed between it and the glass. Also, if you examine the film again, after its final washing from the hypo, you find the lumps still there, but some of them have produced white, others black spots, the white spots being generally round and having a black dot in the centre. These latter are the moons; and they appear to increase in size, before the exposure of the plate, from the spreading of some chemical action of the little black nucleus upon the film. This nucleus may be a particle of foreign matter in the cotton wool which is made into pyroxyline, and it may be acted on in some way by the acids, or retain obstinately a trace of the acids, and in this state, when imbedded in the sensitive collodion film, it may act upon the surrounding portions and render them insensitive,—the action spreading more and more the longer the plate is kept, particularly if exposed to air and moisture. This view of the origin of moons is supported in some measure by the fact that if you examine a bottle of collodion under a magnifier, you nearly always see some undissolved particles in suspension in it. This shews the importance of not shaking the bottle unnecessarily, but allowing these particles to settle as much as possible, and then decanting and filtering the collodion through a suitable filter.

White spots are sometimes called pinholes, and some photographers believe them to proceed very frequently from crystals of iodo-nitrate of silver in the bath which stick to the film; or from undissolved particles of iodide of potassium in the collodion which produce insensitive square transparent spots.

All these causes may combine to produce spots in the negative, as well as others which have not been enumerated or discovered; but the most fertile source of spots I believe to be dust upon the polished plate or upon the sensitive film. Wipe the inside of the camera and dark slide, and blow upon the plate before putting it into the slide. Wage war, in fact, with dust all you can.

FAILURES FROM IRREGULARITY IN THE DRYING OF THE FILM.

You will sometimes find, on examining a dry film, an oval patch in the centre of different density from the rest, or one of the corners more creamy than the rest of the plate; or in the finished negative you may observe rings near the edges, like marks left by the tide upon the sea shore, or perhaps a long white diagonal mark like a finger which commences at the edge of the picture. All these defects are due to irregularities in the draining and drying of the wet film. The way to avoid them is to rest the plate upon its four corners only in a suitable drying box, such as

I shall describe further on, and to let it dry spontaneously at the uniform temperature of the room, with its entire surface freely exposed to the action of the air in the box. The white finger mark alluded to proceeds in all probability from a stream of moisture which has got behind the film from a hole at the edge.

FAILURES IN VARNISHING.

If Spirit Varnish is applied to a cold plate it gives a dim surface like ground glass. In order to get a clear transparent film it is necessary to warm the plate slightly before the fire before applying the varnish, and to heat it strongly after the application; the latter precaution being necessary in order to enable the film afterwards to sustain the sun's heat in printing without being tacky. Spirit varnish should not contain any other resinous matter than bleached lac, as there are many resinous gums soluble in alcohol, the injudicious addition of which renders the varnished film soft and tacky when heated by the sun.

If Spirit Varnish is made with too strong alcohol, and the plate too much heated before being varnished, the negative will sometimes be destroyed and dissolved off the plate, or the film broken up into fragments; and this effect is particularly likely to occur when the collodion contains too much water, or when the pyroxyline is of a kind very soluble in alcohol. An infallible remedy is to pour thin gum water over the

negative whilst it is still wet from the last washing water.

Take care in varnishing a negative not to pour too much varnish upon the plate, and then rock it or invert it so as to let some of the excess flow back again over the film; this produces lines in the varnished negative which shew in the print.

APPARATUS.

APPARATUS.

I HAVE now to describe a convenient set of apparatus by means of which a photographic tourist can prepare and develop dry plates *en route*, in his bedroom, or any other suitable place. But first let me point out the advantage of using a particular kind of camera and lenses, and a particular size of glass plate upon which the pictures are to be taken, as especially suitable to the purpose commonly had in view by artists and amateurs, viz., either to bring home studies from which pictures or parts of pictures can be composed, or truthful views of interesting places or objects met with in their travels,—and to do this with as little heavy luggage as possible.

Let me first endeavour to persuade the reader to work upon small plates, for many reasons. A collodion negative is capable of exhibiting a great deal of beautiful detail, as is proved by the multitude of subjects which have been taken in a single drop of collodion, and viewed under a powerful magnifier or microscope. There is no necessity to work upon large

plates, because an immense amount of fine detail can be got in small negatives, and enlarged prints can be taken from these very successfully and artistically in a solar camera. The artistic qualities of a photograph are in fact greatly enhanced by the process of enlargement, which softens the unnatural hardness of outline, at the same time that it renders full justice to all the gradations of tone. There may certainly be exceptional cases in which an architect or antiquary may require to work upon large plates, but I do not hesitate to say that the artist and amateur of taste will studiously avoid them, for the very reason that large negatives exhibit in excess those qualities which are antagonistic to the picturesque beauty and art character of a photograph. A broad, general truthfulness to nature, is *not* obtained by hard outlines and mechanical elaboration of minute details. When a fine view, or happy combination of natural objects is spread out before the eye of a true artist he does not at once pry into the minor features of the scene and endeavour to make it all out in detail, but pauses for a time to enjoy the agreeably balanced masses of light and shade,—the lines of the composition in their graceful sweep or picturesque intersections,—the vigorous foreground and hazy distances,—the general configuration of the clouds, and their harmony with the rest of the picture,—and so on. All these general features, and the general effect of the whole, are to him infinitely more charming than to strain at distinct

vision of particular objects, as you see persons without taste continually doing. Besides, the retina of the eye is not a fixed focussing screen, like the ground glass of a fixed camera, but part of a living body, and composed of palpitating nerves and bloodvessels, at the same time that the orb of the eye is in constant motion, and only retained in one position by a somewhat painful effort when distinct vision of a particular object is required. Add to this that there are two eyes at work together instead of one, and it is obvious that artists have been all along in the right in blending together the outlines of objects in their pictures, and avoiding as a rule hardness of outline. Look at a view with one eye only and you see it much sharper and harder than when viewed with both, and it looks then more like a common bad photograph taken in a large camera. It is evident then, that if the object of the photographer be to secure artistic studies, or pictures resembling works of art in their general character, he should work upon small plates, and if need be print enlarged positives from these by means of a solar camera, because the operation of enlarging softens the outlines in the exact degree that you require according to the scale of enlargement.

Having thus shewn, I hope, that it is abstractedly right in principle to work upon small plates instead of large ones, I will now bring forward some minor reasons, but very cogent ones, in favour of miniature negatives. Some of these reasons are based upon

optical considerations; and others upon considerations of convenience, economy, and utility.

First for the optical reasons. It is well known that a small picture must be taken with a lens of shorter focus than a large picture including the same objects; the law being that the corresponding linear dimensions of the two pictures are in the ratio of the equivalent focal lengths of the two lenses with which they were respectively taken. It is also well known that the property of a lens called depth of focus becomes greater as the focal length of the lens becomes less; by depth of focus in this case being meant the property by which a lens will give both a near and distant object upon the same line in equally good focus. Suppose, for instance, that one lens has a focal length of 15-ins. and a stop of $\frac{1}{2}$ -in. diameter, so that its "apertal ratio" is one-thirtieth; and that another lens has a focal length of 5-ins. and a stop of one-sixth of an inch diameter, so that its apertal ratio is also one-thirtieth. Now if you fix an upright stick into the sea beach, and plant your camera so that the image of this stick cuts that of the distant horizon behind it, you will find that with the longer focus lens both the image of the stick and that of the horizon at the point where they intersect will be in equally good focus when the camera is about 60-ft. from the stick, and for all distances greater than that, but not when it is brought nearer than that to the stick. Suppose we call this minimum distance of 60-ft. the LIMIT OF FOCAL

RANGE. On repeating the experiment with the shorter focus lens we find the "limit of focal range" to be now only 20-ft.; so that in the first case the longer focus lens includes in equally good focus all objects upon the same line lying between 60-ft. and infinity, whilst the shorter focus lens includes in equally good focus all objects upon the same line which lie between 20-ft. and infinity. The shorter focus lens has, therefore, the greater depth of focus, and therefore the small negative is more perfect, optically, than the other, under the same conditions of exposure. And hence it follows, that if an enlarged print be taken from the smaller negative, of the same size as the large print taken direct from the larger negative, there will be more equality and uniformity of definition over the entire field in the former case than the latter, and this is what is wanted in a large photograph; not excessive sharpness in one part and indistinctness in another, but uniform softness of definition over the whole area of the picture. This superiority of the shorter focus lens over the other in depth of focus is a very important property.

Another advantage of short focus lenses is that some of the unavoidable defects of lenses are less appreciable, and therefore more easily corrected, in small lenses than in larger ones. Lenses are like diamonds; their value does not increase in proportion to their size, but in a vastly higher ratio. And thus it follows, that the apertal ratio may be reduced in small lenses, and the

time of exposure shortened ; so that you may sometimes be able to take an instantaneous picture with the full aperture of a small portrait lens, but not with a large one.

Thus, for depth of focus and rapidity of action, short focus lenses are the best ; and these are indeed very important advantages. The mechanical photographer, who works upon plates 15×12 , may produce not a picture at all, but a hard mechanical work like an architectural drawing,—and not so good even as that, because that is equally distinct in every part, which the photograph cannot be. On the other hand, the artistic photographer who works upon plates not one-fourth the size can, by the enlarging process, produce a really artistic picture, softly defined in every part, and having in this respect the general character of a drawing or painting of the same size. He can also take instantaneous pictures upon his small plates, which our mechanical friend cannot do upon his large ones ; and therefore a much wider and more interesting range of subject is open to him. Large photographs are undoubtedly very grand when they are properly treated, but their artistic value will never depend upon the realization of mechanical excellencies which are antagonistic to pictorial truth.

And now for the convenience and economy of small plates as compared with large ones. But it is surely unnecessary to point all this out ; and to tell the reader, in addition, that in the same time, and with the same trouble, and at the same cost, he can take a much

greater number of pictures upon small than large plates. Still, if he should determine to defy all difficulties, and ignore sound reasoning and common sense, and resolve on taking large negatives direct in the camera, then we would remind him that the paper processes are much more suitable for his purpose than collodion; and that he will find some important advantages in working upon paper which glass does not possess; for paper is light and flexible, and cannot be broken, while glass is heavy, rigid, and fragile. My advice, therefore, is to take large negatives upon paper, small negatives upon glass; and never large negatives upon glass (except for some special object), or small ones upon paper.

There is one more argument in favour of small negatives. The history of photography, as well as the present practice of those who have made a profession of it, prove that small pictures are remunerative but large ones a loss to the producer. All those who have made an exclusive speciality of large photographic views have burnt their fingers and come to grief commercially; instance MM. Bisson, Frères. On the other hand, the card portrait, the small stereoscopic slide, and the micro-photograph have proved a commercial success, and given a living to thousands of operators; whilst there is a probability that the cabinet photographic view, 7×5 , will be the next fashion.

The object will therefore be to choose that size of plate which will be suitable either for the cabinet

view, or the stereoscopic slide, or an instantaneous bit vignetted; and to arrange the camera and lenses in such a way that the artist may be able to take anything that may turn up on his rambles, on one of these three plans,—remembering that an enlarged print can always be taken afterwards from a small negative, if required.

Now, a plate $7\frac{1}{4}$ -ins. square will be found to include all these conditions, and answer all these purposes. For instance, you can take upon it a cabinet view 7×5 ; or a pair of instantaneous views $7 \times 3\frac{1}{2}$; or four instantaneous bits $3\frac{1}{2}$ square; and occasionally a square, or upright, or circular view upon the whole plate. But in order to show practically the advantages of this method of working I will endeavour to give an illustration.

Last summer I went in a boat through Brittany, from St. Malo to L'Orient and back, seeing of course many pretty scenes and interesting places on the way. But although I did not take my camera with me on that trip, I could not help noticing as we went along the variety of pretty subjects which I might have taken with the set of apparatus about to be described; and by way of illustration of the uses of such a set I will try to describe what kind of subjects these were, and how I should have treated them.

The city of St. Malo, taken from Chateaubriand's Island, would have made view the first. It is a small picturesque little place, entirely walled in, and situated at the extremity of a neck of land jutting into the sea.

The lofty houses are seen peeping over the tops of the old walls; and with the church spires, &c., the outline would be sufficiently varied. The rocky shore at your feet would give a bold foreground; and the whole city would be included in a long narrow ellipse which you would take upon the entire plate, and either vignette the print to this general elliptical form, or cut it out sharp by a correct geometrical figure struck with a pair of pins and a slack thread.

Another view upon a whole plate would be got within the town, where the streets are narrow and the houses high and old-fashioned. You would now find an upright view the right thing, and with one side of the narrow street in shadow and the other in sunshine you would get quite a Prout-like picture; and this again would be vignetted with cotton wool, and printed upon a large sheet of paper, so as to leave a broad white margin round the picture.

The jetty at St. Servan, under the old Solidor tower, would give four small bits for a whole plate, taken one after the other. First the tower itself; next one of the odd looking bathing machines peculiar to the place; and lastly, two instantaneous views of one of the Dinard ferry boats,—first, as she is sailing in and just before she hauls down her canvas,—and next, after she is moored alongside and her freight of passengers are paying their fare and coming ashore, consisting chiefly of market women in queer white caps and with large baskets of fruit and vegetables. You would cut the

negative into four before printing these four bits, and vignette each of them with cotton wool. I am a great advocate of vignetting, and am not generally an admirer of photographs trimmed square to the extreme edge of the plate. There is as much art in knowing what to reject in a print as what to include; and you must always be careful not to spoil your print by including anything which would be better left out. The artist photographer should learn as soon as he can a good method of vignetting with cotton wool, and employ it largely if not universally.

On ascending the river with the tide, nothing could be done till you come to the first lock, but in the quiet pool above it, and near the edge of the weir, you would probably see an old fisherman poking lazily about in his boat, which would have a rough bent mast in the bow, and an immense square framed net hanging from the top of it over the water. This would make a capital instantaneous bit for another fourth of the next plate; and when you had taken that, you would probably see one of the picturesque sailing barges of the country coming round the ivy-covered crag at the bend of the river, with her high narrow squaresail clewed up in a bag at the bottom, and looking very pretty among the trees, with the steep wooded banks of the river for a background. Then at Dinan there would be the grand new viaduct, for a whole plate, with its piers reflected in the still water beneath, and the town perched

upon a commanding height above; and the old bridge and quay for another; while in the interior of the town would be several bits for the one-fourth size; some of them portraits for costume, or groups in the market place.

And next, as we follow the windings of the canal into the interior of the country, what a variety of pretty bits would turn up again for the one-fourth plate. For instance, a group of washerwomen thwacking the clothes by the river side; or a rustic bridge over the canal, or under the towing path; or a pretty old château, with its grounds coming down to the water's edge; or a lock, with its black gates and long handles, and a bit of distance seen over the top; or the inside of a lock, with the water rushing in from a higher level through the opened panels in the gates, and squirting through every crack and cranny; or a tumbling weir; or an old flat-bottomed ferry boat hauled up under a shady overhanging tree in the bank above, and crushing the broad lilies and flags and ferns by her side; or a long loaded hay-cart on the brink of a meadow, drawn by fat oxen nearly hidden by the hay over their heads, and stopping now and then to rest under their load, while the driver puts down his fork and takes a long pull at the cider can, (now's your time to take this bit, don't wait till the fellow turns round and stares at the lens); or one of the high two-wheeled carts of the country, with a couple of shaggy white

horses harnessed to it with ropes, and with a sheepskin and bells upon their collar, standing at the door of a waterside cabaret, over which you read "Hotel des voyageurs; ici on donne a boire et a manger", (mind you focus the letters sharp or you won't please Mr. Ross). And then, again, for the whole plate when you get to the large towns, and may have to take a Cathedral doorway, or a Palais de Justice, or a noble bridge or quay.

Such are the kind of subjects for which you would be prepared exactly with your $7\frac{1}{4}$ -ins. square plate and the camera which I will now describe; to say nothing of the pair of stereoscopic pictures which the same plate would include, and which you might take occasionally, if not to please yourself, at any rate to please your friends. For my own part I have got quite tired of the stereoscope, and prefer working for legitimate artistic effect without optical clap trap.

But before going further I must once more caution you, even at the risk of being thought tiresome, against supposing that because your plate happens to be square you are therefore obliged to take all your large views of that shape. Pray don't commit that mistake. If your plate takes in all that you actually want, either in breadth or height, never mind sacrificing without scruple all that you *don't* want just because the plate happens to take it in. Never mind wiping off or vignetting out the useless parts of your picture; or grumble about the waste of glass.

Where's the great trouble after all in an inch or two of bare glass round the picture; and think how convenient it is in the vignetting.

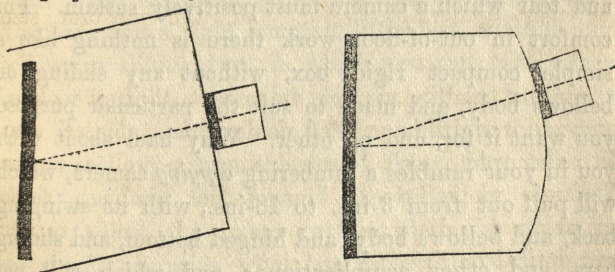
And now for the camera. As we know exactly what we require, let us reason the thing out, and see how the camera ought to be made, so as to satisfy conveniently and perfectly all the required conditions.

The large views must include at least fifty degrees, and they must be free from distortion whenever architectural subjects are taken; you therefore require for them a No. 1, Ross Actinic Triplet, having a back focus of 7-ins., and an equivalent focus of 8-ins., with a set of stops of which the smallest will be the most generally useful, and the medium size the least.

For the small views, on the one-fourth of the plate, you will require a pair of small portrait lenses, also with a complete set of central stops; as well as a pair of single view lenses 5-ins. focus, although these last are not indispensably necessary, but they render your optical outfit more complete.

In taking the large architectural views the plate must always be kept in a vertical plane; for if it is inclined to the vertical by tilting the camera up or down, the upright marginal lines of the architecture will be thrown out of the perpendicular, and appear to fall either inwards or outwards. But if the plate is to be always vertical, some means must be adopted

for shifting the position of the lens whenever it is required either to raise the horizontal line above the middle of the plate, or to depress it below the middle. The most convenient way of doing this that has ever been proposed is by a recent invention of my own, in which the lens is mounted upon a piece of wood which slides upon a circular arc projecting from the front of the camera, and having the centre of the plate for its centre. This new arrangement is called "Sutton's round camera-front", and the idea has been very cleverly carried out by Mr. Ross, and it answers perfectly. A collateral advantage of it is that it gives to the flange of the triplet about $1\frac{1}{2}$ -ins. of projection beyond the flat front of the camera,



so as exactly to suit the excess of focal length of the Triplet over the other lenses; and thus we are enabled to use a light, simple, rigid camera without sliding body or bellows arrangement, or swing back; for the round front does in fact produce exactly the same optical effect as a swing back,—as will be seen by the above diagrams, the left-hand one exhibiting

a common tilted camera with a swing back, and the right-hand one a horizontal camera with the raised slider upon a curved front.

Now what a blessing it is that a light, simple, rigid camera will answer our purpose; for no one who has not worked extensively out-of-doors with the complicated cameras which are now manufactured for amateurs, can form any idea of the nuisance they are to a really sensible practical man. No one who has not worked hard, and in earnest, with a camera amongst fine wild scenery, can form any idea of the nuisance of unnecessary weight, and complication, and delicacy of workmanship in the camera; or of the hard wear and tear which a camera must positively sustain. For comfort in out-of-door work there is nothing like a simple compact rigid box, without any sliding or bellows body, and made to suit the particular purpose you want it for, and no other. Why haul about with you in your rambles a lumbering *copying* camera, which will pull out from 3-ins. to 18-ins., with its swinging back, and bellows body, and hinged bottom, and sliding bars, and other complications; and which will not stand the wind, or the rain, or the sun without shaking, or getting unglued, or warping, and making everything stick fast? Why not have a separate copying camera which you can leave at home; and then having made up your mind what lenses you are going to use, and what size plates you are going to work upon on your tour, have a rigid camera made to suit them, and which

you can screw on to its tripod, and carry about upon your shoulder in sun or rain,—with the bag of lenses and slides in your other hand,—and independent of a troublesome porter to dog your footsteps and worry you when you want to be alone.

Let me then shew how a strong, light, neat little rigid camera may be made to answer all the purposes we have in view. It should be externally about 9-ins. square, and not more than 5-ins. deep. There should be two removeable fronts, one for the Triplet, with a curved slider, the other with four holes and flanges for the shorter focus portrait and view lenses; and inside the camera there should be four removable partitions to insert when the small pictures are taken. That is all. You have now a light compact little box, without any bellows or sliding box, in which you can take either long, or upright, or circular pictures, without turning it upon its side; and which has in addition that very convenient appendage the round front, the value of which you will find beyond all belief, in enabling you to adjust the image to the plate, by doing in one simple operation what has hitherto required two troublesome ones.

I have now shewn that you can do in this rigid camera, and with greater convenience, all that you are likely to want to do on a tour with one of the common ill-designed view cameras, which cost so much money, and have so many complicated adjustments to suit possible contingencies which never occur, and such

bungling ways of meeting those common requirements which do constantly occur, such as taking an upright picture, or shifting the horizontal line. (But I ought rather to say *raising* than *shifting*, because shifting may include depressing as well as raising, and that can't be done at all in the common blundering modern cameras). Convenience is not, however, all that you require in a camera. You must have accuracy in your work. The time has come when distortion in a photograph is mercilessly shewn up by newspaper critics; and we hope ere long to see it made a cause of rejection of any proof in which it occurs from a Photographic Exhibition. But a Triplet lens is not enough to cure distortion. There is a kind of distortion, and that the very worst of all, with which it has nothing to do, viz., the convergency of straight lines which should be perpendicular, produced by the plane of the picture not being vertical. But how are you to level the camera accurately, or adjust the plane of the swing back to the exact vertical, in any of the common instruments? Only by shifting the legs, or shoving them into the ground by jerks, in the former case; or by using a plumb line (perhaps in the wind), or some awkward kind of level in the latter case. Again, how are you to fix your loose levels upon the top of a bellows body;—or if you adopt the excellent plan of levelling the camera by means of screws through the corners of the bronze triangle upon which it rests, how are you to insert the large brass circle upon

which these screws must work in the folding bottom of a bellows camera? You are met here by a great practical difficulty, which can only be overcome by some fresh complication; and therefore, if you wish to take architectural subjects properly, you *must* use a square rigid camera, because that is the only one which can be conveniently and accurately levelled in all positions, and consistently with the other essential conditions which have been laid down.

We have therefore to add the important quality of *accuracy* as peculiar to the camera which I am describing. In the top there is a brass plate, in which are inserted two spirit levels at right angles; and in the bottom a flat brass ring, by which the camera is sustained upon the points of three screws which work through the corners of the bronze triangle, and by means of which the camera is easily and quickly levelled after the tripod has been firmly planted in the ground. As soon as it has been levelled and turned towards the view, so as to include the subject exactly as you wish, the central screw which fastens it to the triangle in the usual way must be tightened, and you must adjust the horizontal line to the right height upon the picture, by means of the round sliding front which carries the lens. The image will then be free from every kind of distortion.

You will next require three double slides to hold six dry plates, and the optical outfit is complete. It is more convenient, I think, to use double slides than a

dark box, because you will find that if you are sufficiently critical and particular in your choice of subjects, and the way in which they are lighted, you will rarely fill even six plates in one good day's work. Better aim at taking a few good subjects than a large number of indifferent ones.

DRY PLATE APPARATUS.

A great deal of this will be rendered sufficiently intelligible by the diagrams which follow; but the reader is recommended to go and see the model set which I have sent to Mr. Ross for inspection.

This set comprises a drying box, with a lid which screws as a developing tray, and in which all the rest of the apparatus necessary in the preparation of the plates is packed, as well as a box containing the plates themselves. The tourist will therefore require three parcels, viz., the drying box, the leather case containing the lenses and camera, and a basket containing the chemicals. Within the drying box are packed the following articles, viz.:

The plate box, and plates.	A copper drying bottle.
Two draining trays.	A polishing board.
A plate-holder for coating.	A non-actinic lantern.
A plate-holder for developing.	A gutta-percha tray.
2 gutta-percha baths, and stand.	A box of weights and scales.

The plate-holder for developing is made to fit the particular size of plate, and that only. The plate rests upon glass supports, in order to prevent stains. It would be difficult to contrive anything which acts better.

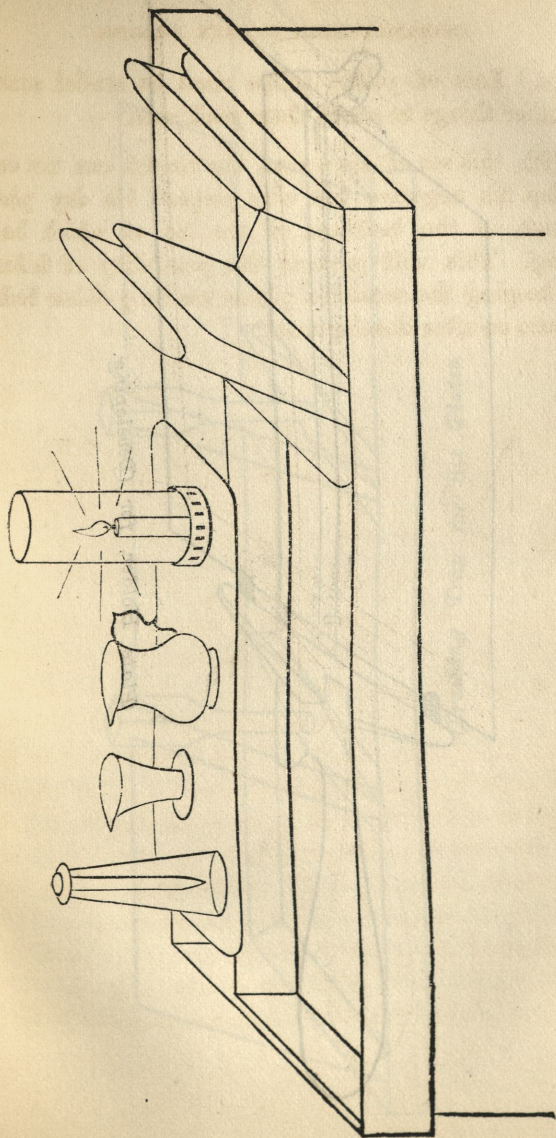
The draining trays and drying box are constructed so that the wet plates may not touch anything except at its four corners. The upright pillars upon which the plates rest when in the draining tray, can be taken down for packing.

The way in which all the baths and other articles are arranged in the developing tray will be understood by reference to the diagrams. The other two diagrams will shew how the plate-holder and draining trays are made, better than any written description.

Before packing up in the drying box the plate box containing the sensitive plates, the drying box and draining trays should be wiped perfectly dry, because otherwise the moisture might affect the sensitive plates. You had better at a pinch pack them inside the camera, wrapped up in yellow calico, and strapped together in pairs, than put them away in a damp box along with wet draining trays. Of course the camera will hold a good many, very safely. The plate box is made to hold four dozen plates including unprepared plates and negatives. The lantern for night-work is made with an orange glass shade, and it is intended for burning thick composition candles, such as are used for carriage

lamps. Lots of yellow calico must be stuffed among the other things to make them pack safe.

With this set of apparatus the tourist can not only develop his negative but also prepare his dry plates *en route*, in the bedroom of the inn at which he is staying. This will prevent the possibility of failures from keeping the sensitive plates too long either before exposure or after development.



Dry Plate Apparatus, arranged ready for use.

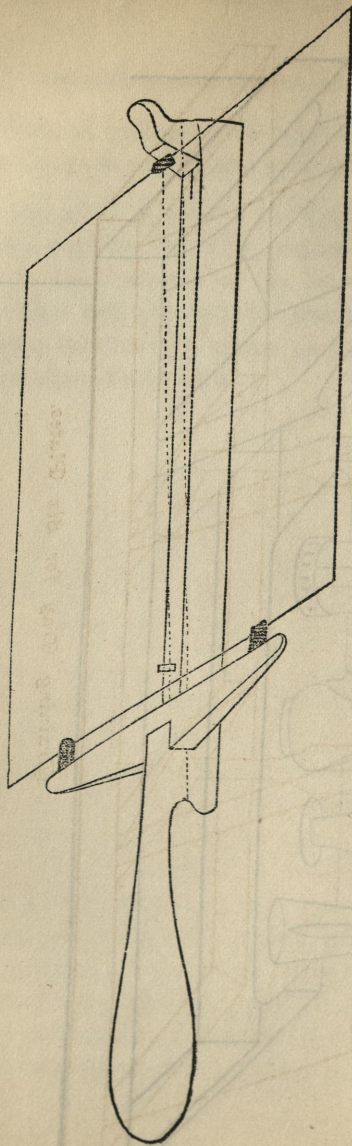
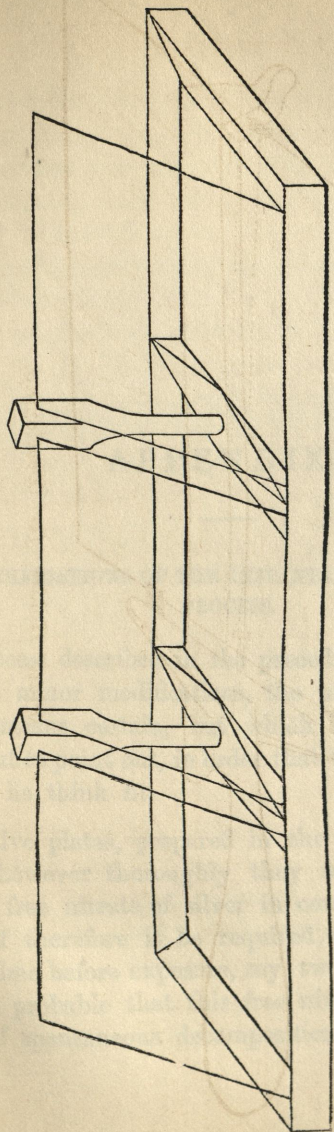
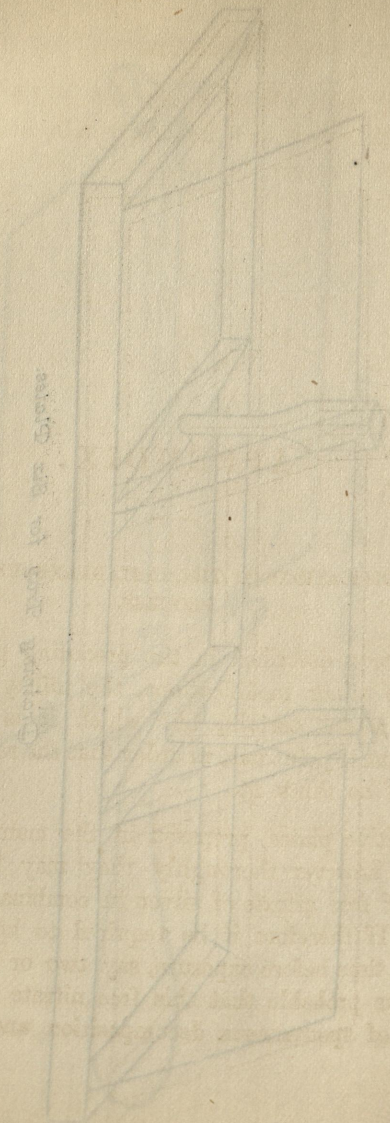


Plate Holder, for Developing.



Draining Tray for Six Plates.

Diagram of the Glider



APPENDIX.

MODIFICATIONS OF THE INSTANTANEOUS TANNIN PROCESS.

THE process described in the preceding pages permits of some minor modifications, the utility of which is by no means certain, but which it is nevertheless important to point out, in order that the reader may try them if he think fit.

Sensitive plates, prepared in the manner described, retain, however thoroughly they may be washed, a trace of free nitrate of silver in combination with the film. If therefore it be required to keep the plates a long time before exposure, say two or three months, it seems probable that this free nitrate may become a cause of spontaneous decomposition and loss of good

qualities. I have therefore tried the effect of washing the sensitive film with salt and water, in order to convert the free nitrate, or at any rate some of it, into chloride of silver. The result is, that the sensitiveness does not seem to be affected at all; while there is good reason to believe that plates prepared in this way would keep all the better for the treatment. About a teaspoonful of salt, dissolved in a pint of water, will be strong enough, and this should be poured over the plate, left to flow backwards and forwards upon it for a minute or two, and then thoroughly washed off; after which the tannin must be applied, and all the other operations conducted as usual.

Some persons have recommended, in the common slow tannin process, to wash the tannin off again after it has been applied, as a means of increasing the sensitiveness. I have tried this plan several times, both in the slow and quick tannin process, but it does not seem to make any wonderful difference in the result whether you leave the tannin on, or wash it off again.

It has been recommended also to add alcohol to the water in which the plate is first washed before development, as a means of increasing the adhesion of the film to the glass; but I have failed to discover any such good result from this course.

Bromised collodion, containing no iodide, has also been recommended; but I have tried this collodion

in every possible way, and have never once succeeded in getting more than a faint trace of a picture, much fogged and stained. Under these circumstances I feel bound to caution the reader against wasting his time and chemicals in experiments with Bromised Collodion. Those who say they have succeeded with such collodion have probably used a substratum of iodized gelatine, or an impure bromide.

Washing the sensitive film with solution of the iodide or bromide of potassium reduces its sensitiveness considerably; and so does leaving it immersed for some hours in a strong solution of salt.

It is not improbable that very good plates may be prepared by using a collodion containing only nitrate of silver, and immersing the film in a bath of mixed iodide and bromide of potassium; then washing the plate, and exciting it in a bath of nitrate of silver, after which the operations are conducted as usual. The advantage of this plan would be that the nitrate bath would not become altered by use, but would remain always in its original good condition. I have obtained some good negatives in this way in the wet process.

The addition of golden syrup to the tannin seems to keep the film in a comparatively soft moist state, which is favourable to sensitiveness. I have not yet however sufficiently experimented in this direction to speak of the plan with confidence. As for the addition

of gum arabic to the tannin, that does not seem to answer at all with the alkaline development. Glycerine with the tannin has also been a failure in my hands, the film being rendered much less sensitive by the addition of this substance. Gelatine may be used instead of tannin, but the negatives are not then quite so easily intensified, and are more liable to fog. Gum arabic alone is a failure with alkaline development, although it is a very fine preservative when the common developer is used.

Hot water development has proved in my hands a complete failure.

THE WET TANNIN PROCESS.

If the plate, prepared as described in this work, be exposed in the camera in its wet state immediately after the application of the tannin, and then immediately developed in the same way as a dry plate, a magnificent negative can be obtained with one half the exposure that is commonly given to wet plates treated in the ordinary way. This is a very important result, and one well worthy the attention of all classes of photographers. If the plate is not exposed wet, but allowed to get dry, the sensitiveness is reduced to that of a common wet collodion plate. This may be proved by drying one half of a wet plate by a hot iron, and then exposing the whole plate, and developing both halves together.

MR. FOTHERGILL'S INSTANTANEOUS DRY PROCESS.

I have obtained some very nice negatives by a new process brought forward last autumn by Mr. Fothergill, in which albumen takes the place of tannin as a preservative, and gives the well-known greenish-yellow tint to the blacks of the negative; which colour being extremely non-actinic, less intensifying is requiring and more delicacy preserved, although I fear with some loss of the good keeping qualities of the sensitive plate. The following is the process :—

When the plate has been excited and well washed, pour over it the following preservative, which should be fresh made, and not mixed until you are ready to use it.

Beat up to a stiff froth some whites of eggs. Let the clear liquid settle; and on the next day decant it, and to every ounce add 20-mins. of ammonia. This is the stock. When required for use take 30-mins. of a 30-gr. solution of nitrate of silver and add to it 15-mins. of ammonia. Mix them well together, and add it to 1-oz. of the albumen from the stock bottle.

The above is the preservative. Apply it to the plate in the usual way; let it remain on a minute; then wash it all off, and put the plate away to dry.

The picture may be developed either by the alkaline method employed for a tannin plate, but with less soda in the developer; or with the same solution made

stronger of pyrogallic acid and containing no soda. After which the feeble negative thus obtained must be intensified in the usual way. When the alkaline developer is used the exposure should be the same as for wet collodion; but when the developer contains no soda, but merely plain pyro, the exposure should be a little longer. In the former case the negative is very slightly veiled, but charmingly full of detail. In the latter case it is clearer and denser, and therefore yields a harder and bolder print.

Unless the preservative, which consists of an ammoniacal solution of albuminate of silver, is fresh made just before use the plates are nearly sure to be much veiled.

This process is rather more troublesome than that with Tannin, and the plates will not be likely to keep so well; but they are quite as sensitive and yield most charming negatives. I have seen plates prepared in this way in London, and exposed ten days afterwards in Jersey, in the month of August, yield faultless negatives, with the same exposure as was given to Dr. Hill Norris's Rapid Dry plates. They had been merely put into the grooves of a common plate box, and they had had a sea voyage from Southampton to Jersey before their exposure. They were prepared, exposed, and developed by Mr. Whiting, of Clapham, and are still in his possession. I have never seen finer negatives by any process than some of these are; and out of a dozen plates not one failed.

THE GUM PROCESS.

In this quick dry process, which was first published in a paper by me which was read before the British Association in 1861, gum arabic is used instead of tannin as a preservative, and the plates are developed, not by the alkaline method, but by the common method with acid pyrogallo-nitrate of silver. The process has turned out a great success in the hands of M. de Brebisson, and he has published a pamphlet on it, and introduced some trifling modifications, such as adding *pâte de jujubes* to the gum arabic, &c.

The gum arabic should be dissolved in the proportion of about 7-grs. to the ounce of water, and applied to the washed sensitive film in the same way as tannin. The plate is to be wetted before development, and developed with the usual acid solution of pyrogallic acid, to which a drop or two of nitrate silver solution is at first added, and afterwards more freely if required. The exposure need not exceed that for wet collodion. The negative will exhibit much of the surface bloom of a good wet collodion negative developed with pyrogallic acid.

This process is somewhat coquettish, and the exact conditions of success are not yet clearly made out. Dr. Hill Norris has said of it that the plates would vary very much in quality and sensitiveness, and would not keep well. His own process appears to be something very similar, but probably with the

improvements which long experience has taught him to be necessary.

If the gum solution is made too strong, say 20-grs. to the oz. instead of 7-grs., the film is very liable to blister, unless a preliminary coating is used.

Gum plates, particularly with a preliminary coating of gelatine, become much more creamy when wetted prior to development. Dr. Hill Norris's plates have this property also, but Tannin plates have not.

It is absolutely necessary, in all the Instantaneous dry processes, to use good bromo-iodized collodion, containing at least as much bromide as I have given in the formula; and a nitrate bath made with the trebly-recrystallized salt. The chemicals which many operators are in the habit of using in the wet process, with iron development, will not be found at all suitable for these dry processes. Common methylated collodion containing nobody knows what, and common nitrate of silver, will only bring miserable failures and the consequent vexation of spirit.

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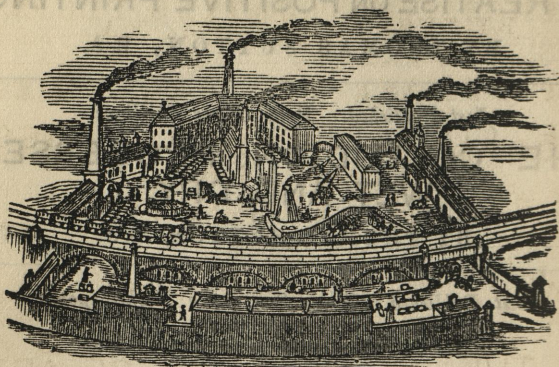
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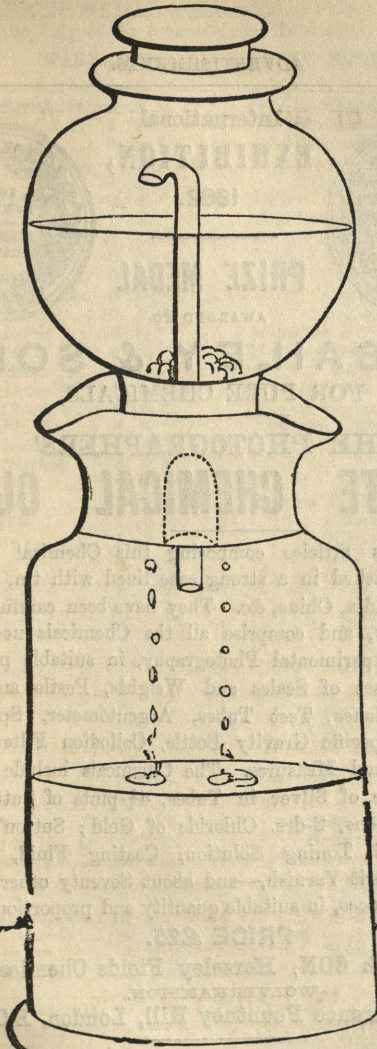
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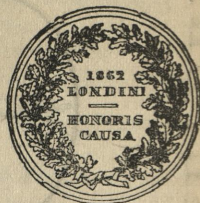


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" Cyanide.....	3	0 "
" Fluoride.....	6	8 "
" Iodide	0	9 oz.
" Sulpo - Cyan.	1	0 bot.
Silver	6	8 oz.
" Acetate	6	0 "
" Ammonia-Nitrate.	6	0 "
" Chloride.....	6	0 "
" Iodide.....	6	0 "
" Nitrate	4	0 "
Soda Acetate	1	4 lb.
" Bicarbonate	0	8 "
" Hyposulphite. 4d.	0	6 "
" Nitrate	1	4 "
" Phosphate	1	4 "
Sodium Chloride.....	1	0 "
" Fluoride.....	6	8 "
Sugar Grape	1	6 "
" Lead	1	4 "
" Milk	1	9 "
Tannin.....	0	8 oz.
Tripoli	2	6 lb.
Uranium Nitrate	2	0 oz.
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" Tunny's Imper.	6	0 "
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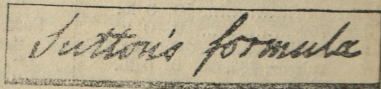
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